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Cleaning up the waste stream — Recycling plastics

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Plastics present special recycling challenge

In 1989, nearly 46 billion pounds of plastics were consumed in the United States. This total does not include textile applications. Of this enormous quantity, only about 1 percent of all manufactured plastics have been recycled.

Recycling plastics is difficult because the waste stream contains a mix of plastics with different properties. Separating different plastics or finding uses for mixed plastics are major recycling challenges. The task is further complicated by increased use of multi-layer packaging, in which layers of different plastics are fused into one container.

Nevertheless, concern over our volume of waste plastics has created growing interest in recycling efforts.

This publication explains the basics of recycling plastics, including the coding system used by manufacturers, commonly used terms, sorting/separating, and the pros and cons of the new, biodegradable plastics.

Public interest in recycling plastics continues to grow. This trend is illustrated by the history of the plastic beverage container, first introduced in 1978. These containers are made of polyethylene and polyethylene terephthalate, or PET.

PET has become the plastic most often recycled as post-consumer scrap. Recycling of PET began almost immediately through the efforts of small entrepreneur recyclers. These early recyclers recognized the intrinsic value of this high-tech polymer. In 1979, only a year after the plastic PET bottle's introduction, 8 million pounds of bottles were recycled. Recycling of the bottles grew to 40 million pounds in 1982, and in 1990, an estimated 225 million pounds of PET beverage bottles were recycled.

Coding

To combat the recycling problem posed by the need to separate different plastics, many manufacturers have adopted a coding system. Containers are stamped with a code indicating the type of plastic from which they are made. Coding makes it possible to sort containers in the recycling process if they are made of a single type of plastic. Codes must be read manually. The table below shows the coding system generally used by manufacturers.

Plastic container code system

Code	Material	% of total
1	Polyethylene Terephthalate (PET)	20-30%
2	High Density Polyethylene	50-60%
3	Low Density Polyethylene	5-10%
4	Vinyl/Polyvinyl Chloride (PVC)	5-10%
5	Polypropylene	5-10%
6	Polystyrene	5-10%
7	All Other Resins	5-10%

Polyethylene (high density and low density) accounts for the largest volume, with 10.4 billion pounds of U.S. sales. Polypropylene contributed another 8 billion and polyvinyl chloride (including copolymers) 7.7 billion pounds. Polyester (thermoplastic and unsaturated, no textiles) accounted for 2.9 billion pounds (6 percent) of U.S. sales. These billions of pounds of thermoplastics offer the opportunity to recycle. The nature of a thermoplastic is such that it can be re-melted or extruded into remanufactured products.

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Commonly used terms

- **PET** ***(polyethylene terephthalate)*** commonly used in soft drink bottles.
- **HDPE** ***(high-density polyethylene)*** used in milk and water jugs, detergent bottles and the base cups of soft drink containers.
- **PVC** ***(polyvinylchloride)*** commonly used in durable construction products such as pipes and siding.
- **LPDE** ***(low-density polyethylene)*** used in plastic film items such as grocery bags.
- **PP** ***(polypropylene)*** common in durable items, fibers and diaper liners.
- **PS** ***(polystyrene)*** familiar in foamed form ("Styrofoam" is a particular brand name) as fast-food packaging, hot cups and meat trays; also used in rigid and semi-rigid containers.
- **Multi-layer or laminates** combine various plastics with different properties in layers with different properties. These are common in food products such as cheese wrap.
- **Thermoset–material** (resin) capable of becoming permanently rigid when cured.
- **Thermoplastic–material** (resin) capable of softening or fusing when heated and hardening again when cooled.

Sorting/separation

Technology is being developed to use mechanical and chemical processes to separate different types of plastics, such as PET and HDPE. Similar technologies are being developed to remove the labels, caps and rings from plastic soda bottles.

Products claiming to be made of recycled materials may contain anywhere from 1 to 100 percent secondary materials, which may be either post-consumer or industrial scrap. However, one point of concern is the number of times a product made from recycled plastics can be recycled. Many products made from recycled plastics must be discarded after one use. Also, the possibility of bacterial or toxic contamination restricts the use of recycled plastics in food containers. Containers used for pesticides and other toxic materials are not permitted for use in recycled materials.

Biodegradable plastics

One attempt to circumvent the problem of waste plastics is the invention of biodegradable plastics. These plastics, which are decomposed by microbes or light, have small amounts of additives, generally about 5 percent cornstarch. However, the speed and environmental conditions in which the plastic will break down has not been determined. The goal is to break plastic down into carbon dioxide and water, but some "biodegradable" plastics merely break into very small pieces rather than changing their chemical make-up. Also, it is not known what really takes place in degradation and if there are any harmful consequences. Unfortunately, degradable plastics cannot be recycled back into the raw material stream.

Because they might become contaminated, no food packaging container has been allowed by the Food and Drug Administration to contain biodegradable plastics.

Summary

The possible benefits of recycling are obvious. Recycling extends disposal capacity, saves money in disposal costs, conserves natural resources, creates jobs, and provides a reliable, cost-effective feed stock to industry.

Products that can be made from recycled plastics are being identified by those manufacturers aware of the opportunities in recycling. Products that are or can be made from recycled plastics today include non-food containers, trash cans, fiber-fill for vests and jackets, traffic cones, carpet backing, insulation, plastic lumber and drain pipe. Yet more products must be identified as compatible with recycling, and more effective recycling methods must be found, before we can begin to absorb more of the waste plastic that is not being reused.

Requirements for a successful recycling operation:

- ✔ Acquire a continuous source of high grade materials.
- ✔ Establish cost-effective collection and transportation.
- ✔ Create recycling processing technology and equipment to handle material efficiently and economically.
- ✔ Develop the ability to market both quality and a continuous quantity of materials.
- ✔ Develop markets for end-products.

Governmental support:

- ✔ Create legislation that aids rather than hinders recycling.

Industry's role:

- ✔ Seek viable, cost-effective products that use recycled materials and products that are designed for efficient recycling.
- ✔ Promote activities that help achieve environmental goals of society.

Consumer's role:

- ✔ Purchase recycled items.
- ✔ Specify a preference for recycled items.
- ✔ Separate plastics for recycling.

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